MD300 HEAT DETECTOR RANGE

PRODUCT APPLICATION AND DESIGN INFORMATION

1. INTRODUCTION

The MD300 range of Heat Detectors forms part of the M300 Series of plug-in units for ceiling mounting. The range is intended for two- wire operation and comprises detectors of different sensitivities. There are also intrinsically-safe versions provided for use in hazardous areas.

2. OPERATING PRINCIPLE

The MD300 range of heat detectors includes both Rate-of-Rise and Static [fixed temperature] types. These detect abnormally high rates of rise of temperature and abnormally high temperatures respectively. A number of types is offered within the range to cater for differing applications. All types have the same operating principle and construction which is described below.

2.1 CIRCUIT DESCRIPTION - RATE-OF-RISE DETECTOR TYPES

A simplified block schematic of the rate-of-rise detector is given in Fig.1.

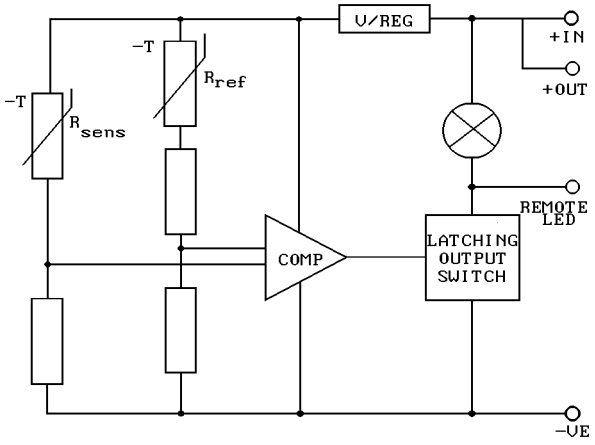

Fig. 1 Simplified Block Schematic Diagram

Two negative temperature coefficient thermistors, Rsens and Rref are used in a bridge configuration as shown. One thermistor, Rsens, is exposed to the air whilst the other, Rref, is thermally lagged inside the detector body. If the temperature of the air around the detector rises quickly, a temperature difference will be established between R_{sens} and R_{ref}. The values of the bridge components are chosen such that if a particular rate of change of temperature is sustained for sufficient time, the comparator will change state and the detector will signal an alarm condition.

If the rate of temperature increase is very slow then the temperatures of the sensing and reference thermistors will be more nearly equal. Under these conditions the bridge components ensure that the comparator changes state when the predetermined fixed temperature is reached.

Three Rate-of-Rise detectors are offered within the MD300 range, each having rate sensitivity and fixed [static] temperature setting to suit a particular type of application. Details of the response characteristic can be found in paragraph 4.5.4.

2.2 STATIC [FIXED TEMPERATURE] TYPES

The 'Static' detectors are similar to the 'Rate-of-Rise' types except that the reference thermistor is replaced by a fixed resistor. The detectors, therefore, no longer respond to rate of rise of temperature. The bridge components are chosen instead to cause the comparator to change state when the sensing thermistor reaches a predetermined temperature irrespective of the rate of change.

Two temperature settings are available in the MD300 range to suit particular applications.

3. MECHANICAL CONSTRUCTION

The major components of the MD300 range of detectors are:

- Body Assembly
- Hybrid/PCB Assembly
- Sensor Housing
- Outer Cover

An exploded view of the complete detector assembly is given in Fig.2.

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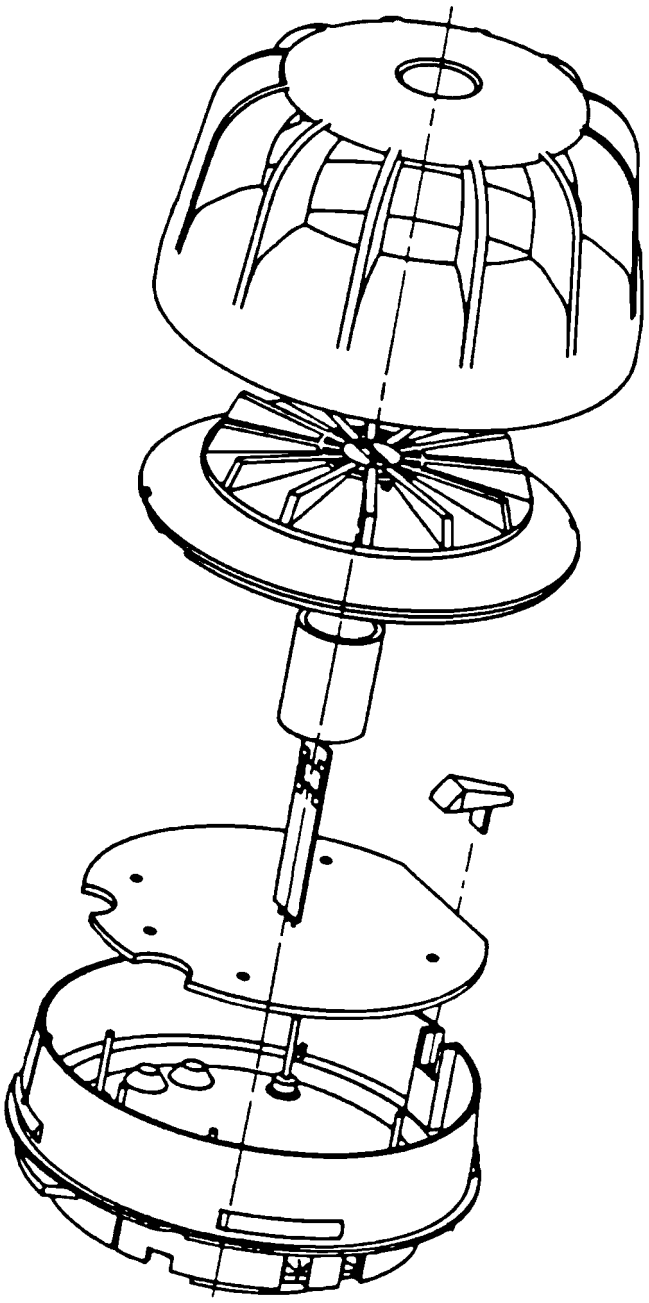

Fig. 2 General Assembly, MD300 Heat Detector

3.1 BODY ASSEMBLY

The body assembly consists of a plastic moulding to which are secured the four detector contacts which align with the contacts in the M300 Base. The moulding incorporates securing and polarising features to retain the detector in the base.

The inside surface of the moulding is metallised to provide shielding against EMI [Electro-Magnetic Interference]; the connections between the contacts and the PCB are made using feed-through capacitors.

3.2 HYBRID/PCB ASSEMBLY

The MD300 range of detector uses a unique construction for the sensor [patents applied for] in which all critical circuit components are contained within a single thick-film hybrid circuit. This hybrid also incorporates the n.t.c. thermistors which are printed and fired onto the ceramic substrate using a special temperature-dependent ink. Reference and sensing thermistors are thus made under identical conditions which ensures good matching and very good tracking with both temperature and age. Excellent reproducibility and long-term stability are thereby guaranteed.

The hybrid circuit is conformally coated with epoxy to provide environmental protection, and then mounted on a circular printed circuit board. The circuit board provides interconnections to the detector terminals as well as carrying a small number of additional components which include the LED alarm indicator.

Secured to the feed-through capacitors in the body to provide good rejection of line-borne and air-borne EMI, the PCB assembly is encapsulated in epoxy, together with the major part of the hybrid circuit, in order to provide environmental and mechanical protection.

3.3 FINAL ASSEMBLY

After encapsulation, the prism and sensor housing are fitted to the body assembly. Finally, the outer cover is snapped into position on the body to provide mechanical protection to the otherwise exposed sensing thermistor.

4. TECHNICAL SPECIFICATION

4.1 GENERAL

The detectors in the MD300 range differ mainly in their response characteristics. Unless otherwise specified, the information given below applies to all types.

4.2 MECHANICAL

Dimensions

The overall dimensions are shown in Fig.3

Material

Body and cover:	"BAYBLEND" ABS/ Polycarbonate alloy Thermoplastic, self-colour white.

Weight

Detector:	0.18kg
Detector plus Base:	0.28kg

Environmental

Temperature Long-Term:	-20^{o}C to +90^{o}C
Temperature Short-Term [<3min.]:	-40^{o}C to +120^{o}C

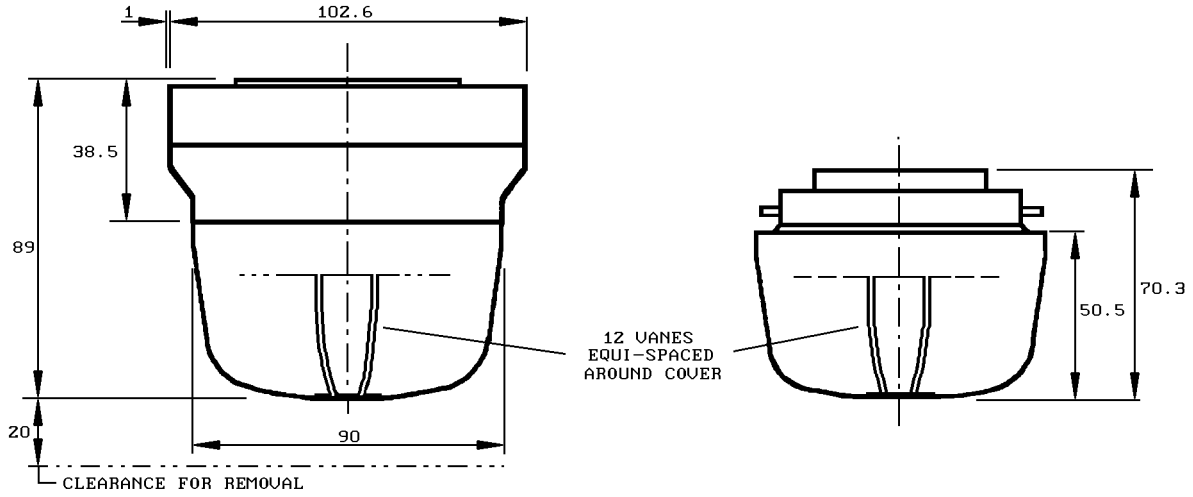

Fig. 3 Overall Dimensions MD300 Detector Range

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Note: The maximum temperatures quoted are those at which the detector may sustain permanent damage. Maximum ambient temperatures at which detectors may be used, without high false alarm rates, are dependent upon detector type.

Relative Humidity: 95% non-condensing

Shock:
Vibration:
Impact:
Corrosion: } To BS 5445:Pt 5 [EN54-5]

EMC: Equals or exceeds the requirements of BS EN 50081-1 and BS EN 50082-1.

4.3 ELECTRICAL CHARACTERISTICS

Table 1 shows the electrical characteristics, these are taken at 25°C with an operating voltage of 20V unless otherwise specified. The alarm load presented to the controller by the detector is shown in fig. 4.

4.4 INTRINSIC SAFETY

The MD301Ex, MD303Ex and MD305Ex detectors are designed to comply with BS5501: Pt 7 [EN 50 020] for intrinsically safe apparatus.

Each type is design to be certified:

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and to be used in conjunction with a shunt diode safety barrier in a certified intrinsically-safe system.

Characteristics	Min.	Typ.	Max.	Unit
Operating Voltage [d.c.]	15	20	24	V
Operating Voltage [Ex's]	16	20	24	V
Quiescent Current			100	µA
Switch-on-Surge			200	µA
Stabilisation Time		50		sec
Alarm Current	5	25	60	mA
Alarm Current [Ex types]	5	20	50	mA
Holding Current	0.5	1	5	mA
Holding Voltage	1.5	2.5	3.54	V
Reset Time	0.01	0.1	0.5	sec
Remote LED drive	Alarm Current less 10 mA			

Table. 1 Electrical Characteristics

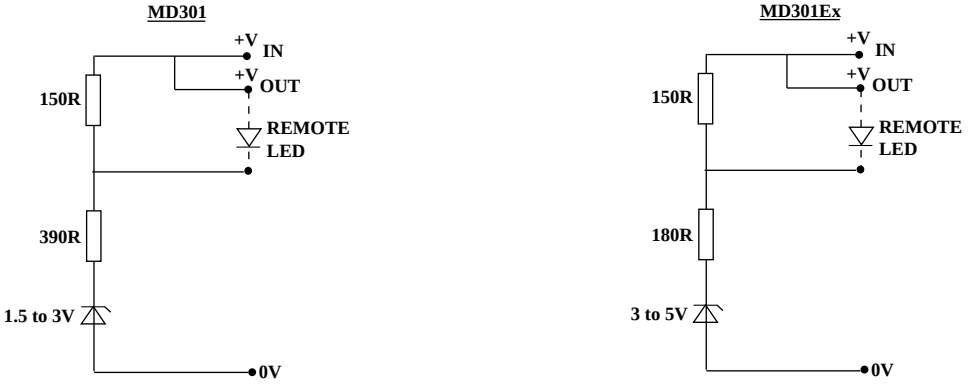

Fig. 4 Alarm Load Presented to the Controller by the Detector

Electrical and performance details are generally the same as for the safe-area equivalent detectors. The following additional information is applicable to Ex types:

Maximum Voltage [for safety]	28V
Maximum Power Input:	1W
Equivalent Inductance:	0
Equivalent Capacitance:	1.5nF

4.5 PERFORMANCE CHARACTERISTICS

4.5.1 GENERAL

The performance of Heat Detectors is normally specified in two ways. These are:

a) by the 'Static Operating Temperature' which is the temperature at which an alarm is given if the temperature rises very slowly and,

b) by the 'Rate-of-Rise Characteristic' which describes the way in which the detector responds to different rates of change of air temperature.

Both of these characteristics are used in the relevant British and European Standards for Heat Detectors. These are BS5445:Pt 5 [EN54 Pt 5] and BS5445:Pt 8 [EN54 Pt 8] covering detectors for use in normal and high ambient temperatures respectively.

4.5.2 DETECTORS FOR NORMAL AMBIENT TEMPERATURE

In the MD300 range, the MD301 [MD301Ex], MD311 and MD303 [MD303Ex] are intended for use in normal ambient temperatures. As such, they meet the requirements of BS5445:Pt 5 [EN54 Pt 5] and give the following response grades according to those standards, viz.

MD301 [MD301Ex]	Grade 1
MD311	Grade 2
MD303 [MD303Ex]	Grade 3

Typical response times measured using the method of the above standard are given in Table 2. Static operating temperatures and maximum recommended ambient temperatures are also given.

Rate-of-Rise ^{o}C/min	Typical Response Time [min:sec]		
	MD301	MD311	MD303
30	1.30	1.40	2.12
20	1.57	2.16	2.35
10	3.28	4.12	5.12
5	6.33	8.08	9.52
3	10.45	13.30	16.16
1	33.00	39.00	48.00
Static	59	60	75
Max.Ambient	40	45	55

Table. 2 Typical Response Times

4.5.3 DETECTORS FOR HIGH AMBIENT TEMPERATURES

If ambient temperatures are above 55^{o}C then the MD312 or the MD305 [MD305Ex] should be used. The MD 312 is a 'fixed temperature' detector which has a static operating temperature of 90^{o}C whilst the MD305 is a 'rate-of-rise' detector conforming to BS5445:Pt 8 [EN54 Pt 8] for temperature Range 2.

Both detectors are suitable for ambient temperatures up to 75^{o}C maximum. The MD312, being a fixed temperature device is more suitable for environments in which rapid changes between normal [25^{o}C] and high [70^{o}C] temperatures occur.

4.5.4 SUMMARY OF TYPES

Table 3 summarises all the variants within the MD300 range. Each is identified by a coloured spot in the centre of the outer cover. The relevant colours are given in the table.

DESIGNATION	DESCRIPTION	IDENTIFICATION COLOUR
MD301	Grade 1	Green
MD301Ex	Grade 1, Intrinsically-Safe	Green
MD303	Grade 3	Red
MD303Ex	Grade 3, Intrinsically-Safe	Red
MD505	Temp. Range 2 (98^{o}C)	Blue
MD505Ex	Temp. Range 2 (98^{o}C) Int- Safe	Blue
MD311	Static 60^{o}C (Grade Z)	Yellow
MD312	Static 90^{o}C	Brown

Table. 3 Summary of MD300 Range

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5. ASSOCIATED EQUIPMENT

The detector is compatible with the current standard range of Low-Voltage Fire Control Units as supplied by the Company.

6. ORDERING INFORMATION

	Stockcode
Heat Detector Type MD301 [Grade 1, R-O-R]:	516-023-001
Heat Detector Type MD301Ex [Grade 1, R-O-R, I/S Version]:	516-023-002
Heat Detector Type MD303 [Grade 3, R-O-R]:	516-023-003
Heat Detector Type MD303Ex [Grade 3, R-O-R, I/S Version]:	516-023-004
Heat Detector Type MD305 [Temp. Range 2]:	516-023-005
Heat Detector Type MD305Ex [Temp. Range 2, I/S Version]:	516-023-006
Heat Detector Type MD311 [Fixed Temp. 60^{o}C]	516-024-001
Heat Detector Type MD312 [Fixed Temp. 90^{o}C]	516-024-002

7. RELATED PUBLICATIONS

01A-02-D2	DESIGN INFORMATION, M300 SERIES DETECTOR BASE AND ACCESSORIES
01A-02-I1	INSTALLATION, M300 SERIES DETECTOR BASE AND ACCESSORIES
01A-02-C1	COMMISSIONING, M300 SERIES DETECTOR BASE AND ACCESSORIES
01A-02-S1	MAINTENANCE AND SERVICE, SERIES M300 DETECTORS AND BASE.

JM/jm
6th February 1997